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*Experiments on the Restoration of Paralysed Muscles by Means of Nerve Anastomosis. Part III.—Anastomosis of the Brachial Plexus, with a Consideration of the Distribution of its Roots.**

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(Communicated by Prof. J. G. McKendrick, F.R.S. Received February 11, 1915.)

(Abstract.)

In two former communications† experiments on anastomosis of nerves as applied to the facial nerve in the dog and in the monkey and to the limb nerves in the dog were published. The series of experiments presented in this paper has reference to anastomosis as applied to the roots of the brachial plexus. In the brachial plexus, as compared with the nerves in the limb distal to the plexus, experiments of this nature require special consideration, as in the former the fibres to the same muscle or muscles usually pass in more than one root, and consequently any conclusions from the operation of anastomosis are liable to be fallacious, unless this is taken into account.

It is necessary, therefore, to consider in these experiments on anastomosis also the question of the distribution of the roots of the plexus.

In two of the experiments only a single root, namely, the fifth or the sixth cervical, was permanently cut off from its centres and attached to a neigh-

* The expense of this research has been defrayed by a Government Grant from the Royal Society.

† 'Phil. Trans.,' B, vol. 202, p. 93 (1911), and vol. 205, p. 27 (1914).

bouring root. In all the other experiments two or more than two roots were dealt with. In the case of the former the temporary loss of function of the limb was very early restored, namely, commencing in 10 and 36 days respectively, and being completed in a further period of 9 to 15 days respectively.

When two or more than two roots were divided more extensive and more abiding paralysis resulted, and the recovery commenced much later, namely, at periods ranging from 79 to 107 days, and reached its maximum in additional periods which varied from 32 to 39 days. The contrast was, therefore, very marked between the recoveries after section of less than two roots, and those following section of two or more than two roots, and led to the conclusion that in the former the cause of recovery was different from that in the latter.

In the experiments in which two or more roots were divided, some were anastomosed to the spinal accessory and others to another root or other roots of the plexus, and comparison is made of the recoveries in these two forms of experiments. Comparison is also made with the results obtained in the two previous communications, and a marked correspondence is found in the dates of recovery when that was clearly due to the substituted nerve.

The views of other authors as to the distribution of the roots of the plexus are discussed, and also the views with reference to the comparison between the plexus of *Macacus* and that of Man.

The author's observations of 38 human plexuses in which he has operated for injury to the roots of the plexus are then considered, and conclusions as to the distribution of the roots drawn from the distribution of the paralysis, the nature of the damage to the roots discovered at the operation, the effects of the excision of the damaged parts, and the results of stimulation of the fifth, sixth, and seventh cervical nerves during the operation. These results of stimulation are compared with the results of stimulation of the same roots made in *Macacus*.

The following are the general conclusions from the research:—

1. The brachial plexus of *Macacus* and that of Man are practically identical, at least as regards the fifth, sixth, and seventh cervical nerves, the variation being of the nature of a prefixture of the plexus in Man, but not to the extent of an entire root.
2. In *Macacus* section of the fifth nerve alone paralyses no muscle and limits no movement, although it may weaken some.
3. In *Macacus* section of the sixth and part of the seventh disturbs the function of the limb to an appreciable extent, but the disturbances can be compensated for and the movements regained, although probably with

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diminished strength, without reunion of the roots and without aiding the recovery of function by anastomosis.

4. In *Macacus* section of both fifth and sixth nerves almost entirely or entirely paralyses the deltoid, but not entirely the flexors of the elbow or the supinators, but in *Man* section of these two roots not only completely paralyses the deltoid, but also the external rotators of the arm, the flexors of the arm to such an extent at least that they cannot produce flexion, and also the supinator brevis to such an extent that it cannot produce supination, and in some cases also paralyses the extensors in the forearm.

5. In *Macacus*, in order to paralyse completely not only the deltoid but also the flexors of the elbow and the supinator brevis, it is necessary to divide the fifth, sixth, and seventh nerves, as apparently more of the fibres to the flexors of the elbow pass in the seventh nerve than in the case of *Man*.

6. In *Macacus* the paralysis resulting from section of the fifth and sixth may be largely restored by anastomosis of the peripheral segments of the two roots to the seventh cervical nerve, or to the spinal accessory, and the resulting restoration of the muscles does not materially differ in date of onset, in progress, or in ultimate result in the two cases.

7. The time taken for restoration of function by means of anastomosis is approximately the same in the case of the brachial plexus in *Macacus*, and in the case of the limb nerves distal to the plexus in the *Dog*, and in the case of the facial nerve in the *Dog* and in *Macacus*.

Electrical Effects accompanying the Decomposition of Organic Compounds. II.—Ionisation of the Gases produced during Fermentation.

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(Communicated by Dr. A. D. Waller, F.R.S. Received February 26, 1915.)

[This paper is published in 'Proceedings,' Series A, No. 632 (vol. 91).]
